



*Environmental
Quality*

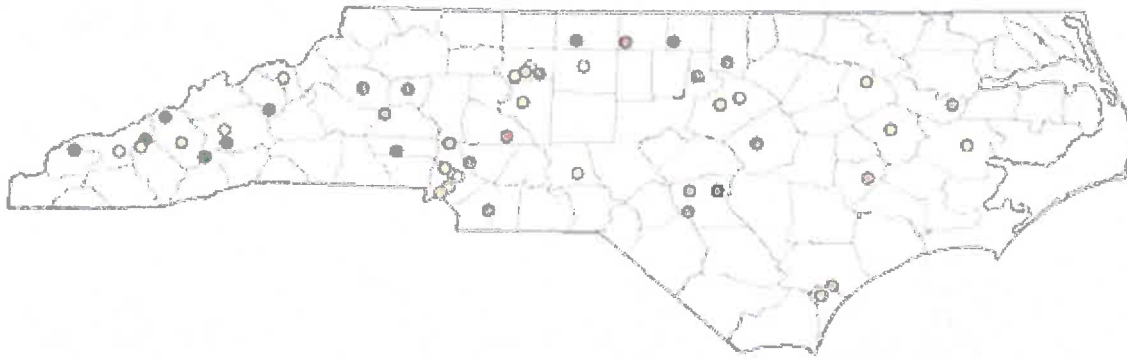
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2016-2017 Annual Monitoring Network Plan for the North Carolina Division of Air Quality

Volume 1

Addendum 2 Revised



December 20, 2016

North Carolina Division of Air Quality
A Division of the North Carolina Department
of Environmental Quality
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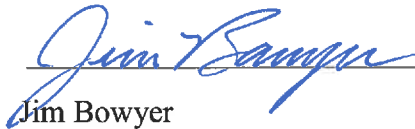


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CERTIFICATION

By the signatures below, the North Carolina Division of Air Quality, DAQ, certifies that the information contained in this 2016-2017 Annual Monitoring Network Plan Addendum is complete and accurate at the time of submittal to EPA Region 4. However, due to circumstances that may arise during the sampling year, some network information may change. A notification of change and a request for approval will be submitted to EPA Region 4 at that time.

Signature

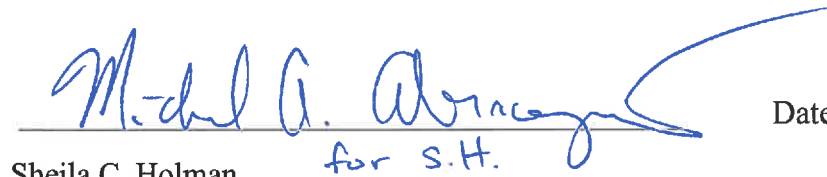


Jim Bowyer

Acting Ambient Monitoring Section Chief, DAQ

Date 12/20/16

Signature



Sheila C. Holman
Director, DAQ

Date 12/20/16

Addendum 2 Revised. Duke Progress Energy Skyland Siting Analysis and Additional Site Information

Duke Energy Asheville SO₂ Modeling for Monitor Placement

Introduction

On June 22, 2010, the United States Environmental Protection Agency, EPA, revised the primary sulfur dioxide (SO₂) National Ambient Air Quality Standard (NAAQS) (75 FR 35520). The EPA promulgated a new 1-hour daily maximum primary SO₂ standard at a level of 75 parts per billion (ppb), based on the 3-year average of the annual 99th percentile of 1-hour daily maximum concentrations.

On May 13, 2014, the EPA proposed the Data Requirements Rule (DRR) for the 1-Hour SO₂ NAAQS (79 FR 27445). The final DRR was promulgated on August 21, 2015 (80 FR 51051)¹ and requires states to gather and submit to the EPA additional information characterizing SO₂ air quality in areas with larger sources of SO₂ emissions. In the DRR, air agencies have the choice to use either monitoring or modeling to characterize SO₂ air quality in the vicinity of priority SO₂ sources, and submit the modeling and/or monitoring to the EPA on a schedule specified by the rule. To meet the DRR requirements, the North Carolina Division of Air Quality, DAQ, opted to do modeling for the Asheville facility.

However, this analysis was conducted to identify a suitable 1-hour SO₂ source-oriented monitoring site location for a special purpose industrial DRR-like monitor to characterize maximum measured concentrations of sulfur dioxide in the vicinity of the Duke Energy Asheville facility. Currently, the closest SO₂ monitor is about 80 kilometers west of Duke Energy Asheville, located at 30 Recreation Park Drive, Bryson City, NC. The 1-hour background monitored air concentration for the area based on 2014 data from that monitor is 1.1 ppb (2.9 µg/m³).

Duke Energy Asheville

Duke Energy's Asheville Plant is a coal-fired electric generating facility located at 200 CP&L Drive in Arden, NC. The facility produces steam in two coal-fired combustion units (Units 1 and 2) and the steam is routed to steam turbines that produce electricity to sell to residential or industrial consumers. The facility is not a significant source of SO₂ emissions since it emits less than the 2,000 tons per year threshold specified in the DRR for determining which sources need to be evaluated in determining area NAAQS compliance designations. However, this facility was modeled and shown to potentially violate the SO₂ NAAQS by a third-party, The Sierra Club.

A part of the requirements for the DRR is the consideration of other sources of SO₂ emissions in the vicinity of the facility. The only other large source of SO₂ emissions in the region, Evergreen Packaging in Canton, NC, is over 25 kilometers away from Duke Energy Asheville. This facility

¹ Data Requirements Rule for the 2010 1-Hour Sulfur Dioxide Primary National Ambient Air Quality Standard, Federal Register of August 21, 2015, (80 FR 51052)(FRL-9928-18-OAR), 2015-20367.

is a significant source of SO₂ emissions since it emits more than the 2,000 tons per year threshold specified in the DRR and is being examined in a different exercise. However, the facilities are far enough apart to not impact the same areas.

AERMOD Modeling

As described in the EPA SO₂ NAAQS Designations Source-Oriented Monitoring Technical Assistance Document (Monitoring TAD),² NCDAQ's modeling followed the recommendations of the SO₂ NAAQS Designations Modeling Technical Assistance Document (Modeling TAD). According to the Modeling TAD, given the source-oriented nature of SO₂, dispersion models are appropriate air quality modeling tools to predict the near-field concentrations. The AMS/EPA Regulatory Model (AERMOD) was used, as suggested in the Monitoring TAD. AERMOD is the preferred air dispersion model because it is capable of handling rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including, point, area, and volume sources) to address ambient impacts for the designations process.

Three years of hourly SO₂ Continuous Emissions Monitor (CEM) data for each of the two stacks at the Duke Energy Asheville facility were used in the modeling. Following the example in Appendix A of the Monitoring TAD, normalized emission rates were used as input to the model. Because of the linear scalability of emissions to modeled concentrations, the relative model results using normalized emissions can be used to predict the location of maximum concentration gradients. The CEM emissions rates were normalized by dividing each hour's rate by the highest overall rate over all stacks throughout the period. Building locations, sizes, and orientations relative to stacks were input into BPIP-PRIME to calculate building parameters for AERMOD. Table 1 provides the stack parameters used in the modeling analysis.

Table 1. Parameters for Duke Energy Asheville SO₂ Modeling for Monitor Placement

Source ID	Easting (X)	Northing (Y)	Base Elevation	Stack Height	Temperature	Exit Velocity	Stack Diameter
	(m)	(m)	(m)	(m)	(K)	(m/s)	(m)
UNIT1	359,957.5	3,926,328.5	662	99.7	324	17.3	5.0
UNIT2	359,963.9	3,926,328.5	662	99.7	322	17.1	5.0

Receptors were spaced 100 meters apart along the fence line. A set of nested Cartesian grid receptors were generated extending outward from the fence line. The receptors were spaced 100 meters apart out to 3 km from the facility center, 500 meters apart from 3 to 5 km out, and 1000 meters apart from 5 to 10 km out. Receptors were removed from the model if they were within the fence line of the facility or in areas not suitable for the placement of a permanent monitor such as open water. The following figures are included to show the facility and modeling inputs.

² SO₂ NAAQS Designations Source-Oriented Monitoring Technical Assistance Document, U.S. EPA, Office of Air and Radiation, Office of Air Quality Planning and Standards, Air Quality Assessment Division, December 2013, Draft.

Figure 1 is an aerial photo of the facility, Figure 2 shows the emissions point and building locations, and Figure 3 shows the receptor placement.

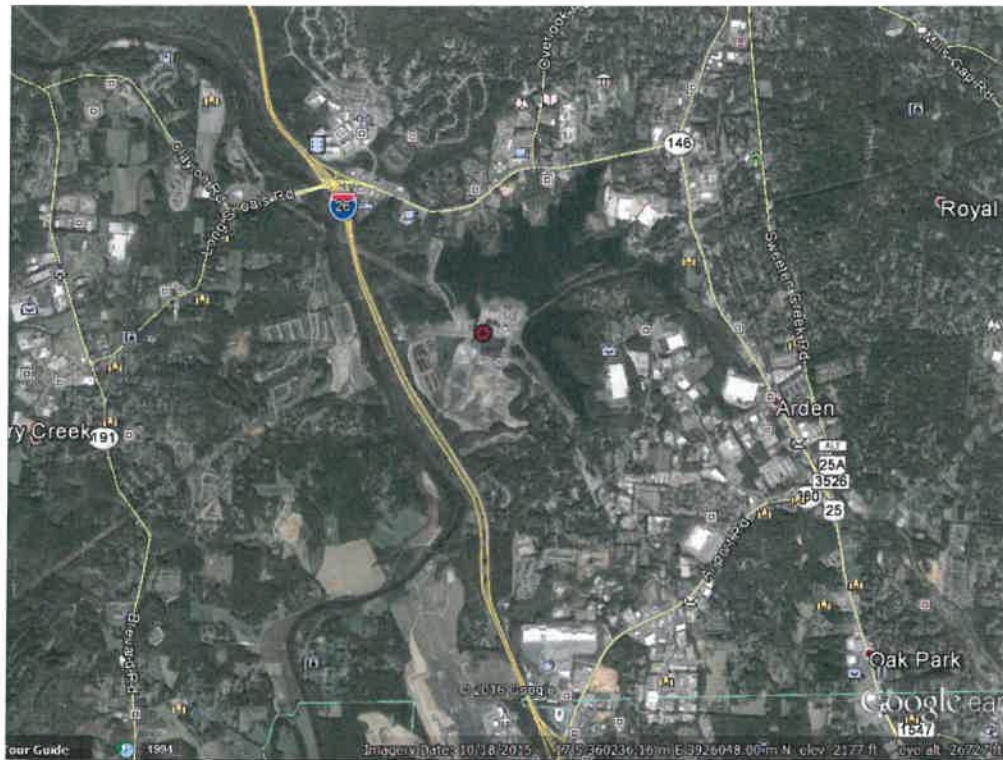


Figure 1. Aerial View of Duke Energy Asheville and Surrounding Areas

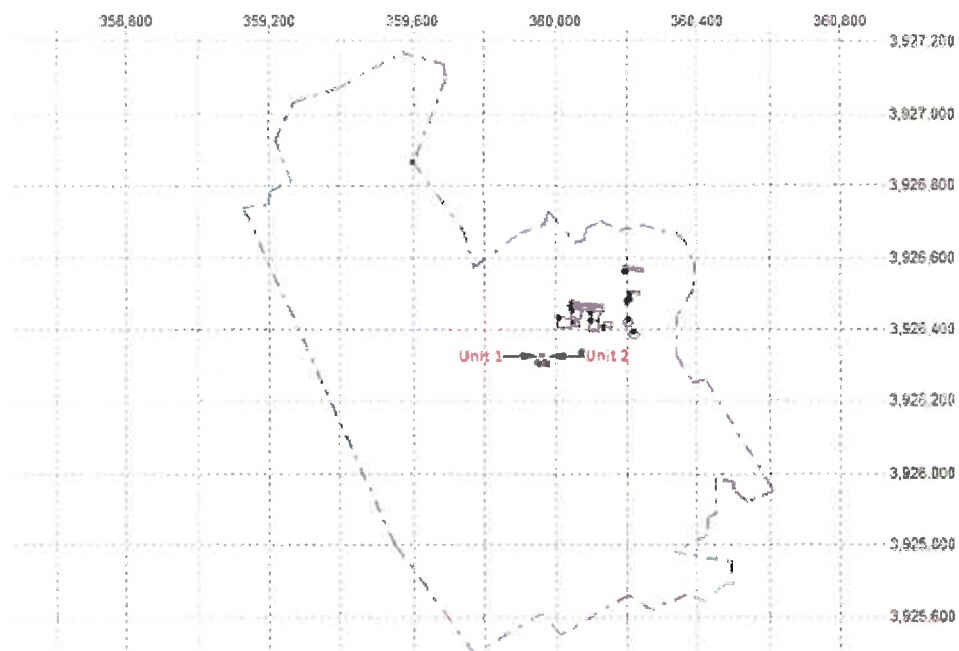


Figure 2. Locations in Duke Energy Asheville SO₂ Modeling for Monitor Placement (UTM NAD 83 Coordinates in Meters, Zone 17)

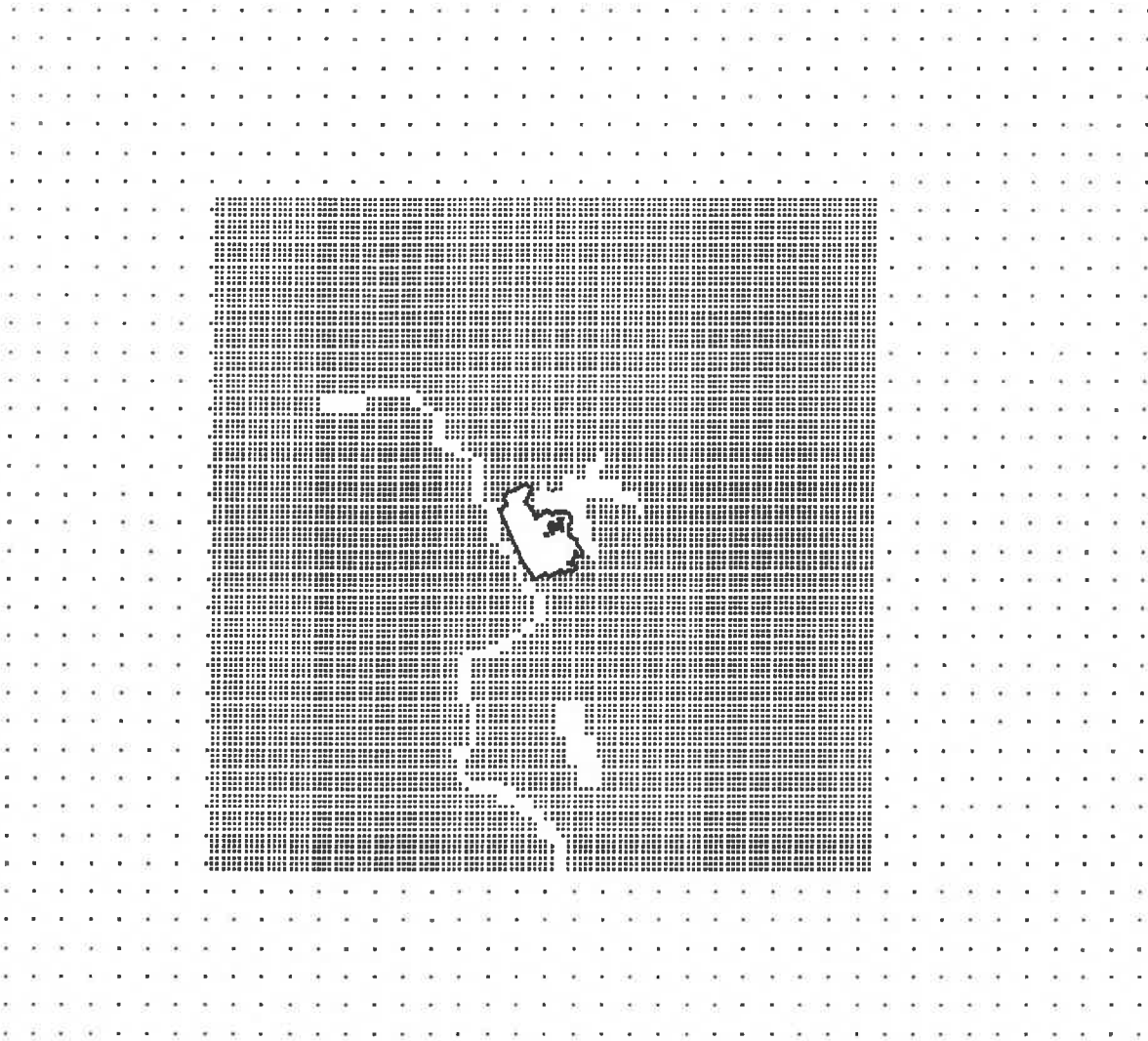


Figure 3. Receptor Grids in Duke Energy Asheville SO₂ Modeling for Monitor Placement Receptor

Terrain data used in the analysis were obtained from the USGS Seamless Data Server at <http://viewer.nationalmap.gov/viewer/>. The 1 arc-second NED data were obtained in the GeoTIFF format and used in determining receptor elevations and hill heights using AERMAP. National Weather Service (NWS) Automated Surface Observation Station (ASOS) data for 2012 to 2014 for the station located at Asheville, NC were processed using AERMET together with upper air data for the same period from Greensboro, NC. AERMinute was also used in processing the data to incorporate additional wind data.

Modeling Results and Ranking Methodology

Following the guidance outlined in Appendix A of the Monitoring TAD, normalized modeled impacts were used to determine suitable locations for installing an SO₂ monitor near Duke Energy Asheville. The three-year average of each year's 4th daily highest 1-hour maximum concentration (99th percentile of daily 1-hour maximum concentrations) was calculated for each receptor. This value is commonly referred to as the design value (DV). Because normalized emissions were used to calculate these values, the results are referred to as normalized design values (NDVs) in this analysis.

Figure 4 shows a contour plot of the NDVs for the receptors near Duke Energy Asheville. Individual NDV's for the higher areas are also presented. The pushpin represents the proposed monitor location.

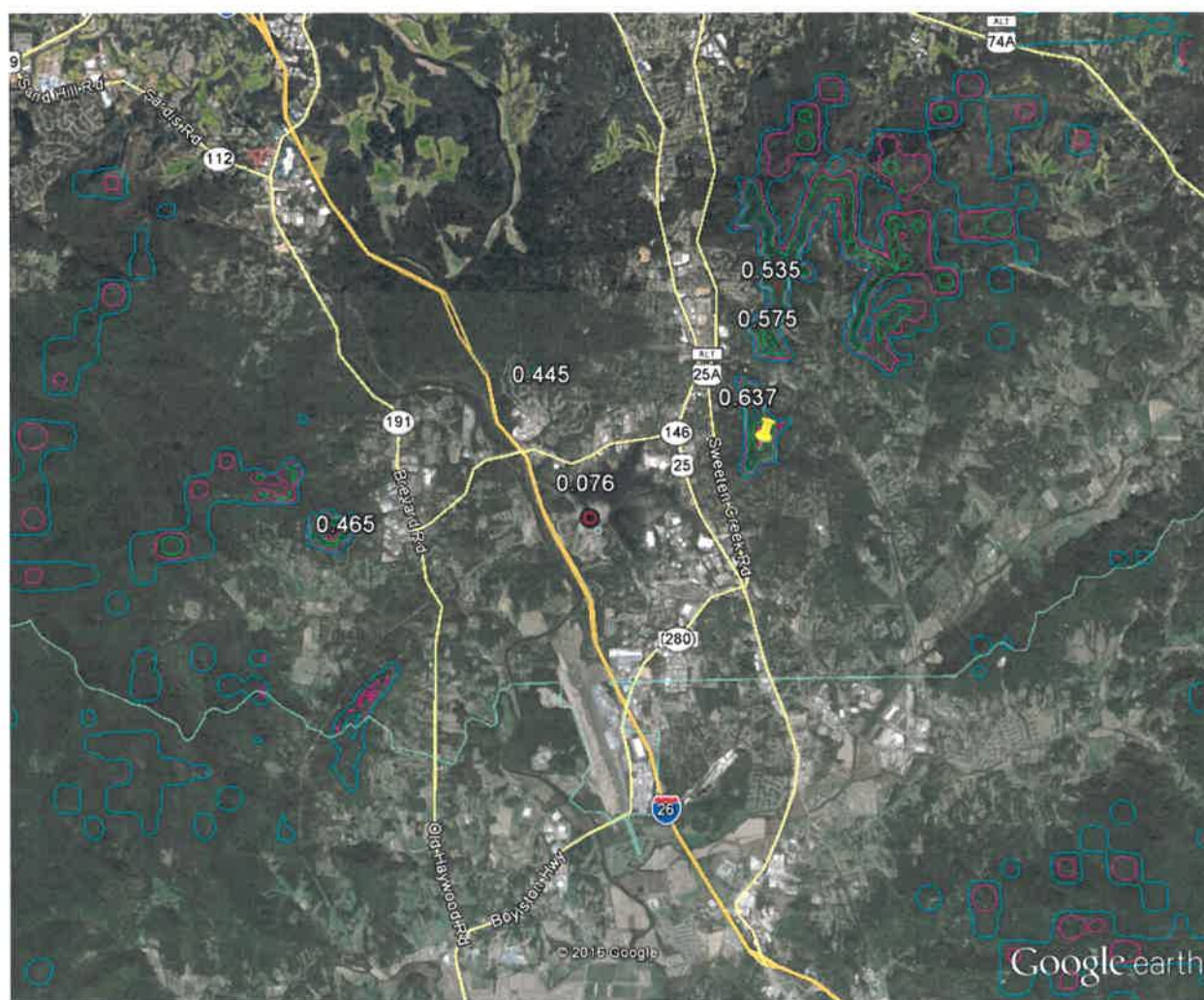


Figure 4. Modeled NDVs for Duke Energy Asheville

According to Appendix A of the Monitoring TAD, the site selection process also needs to account for the frequency in which a receptor has the daily maximum concentrations. The frequency is the number of times each receptor was estimated to have the maximum daily 1-hour concentration. Figure 5 shows the results of the frequency analysis. The pushpin represents the proposed monitor location.

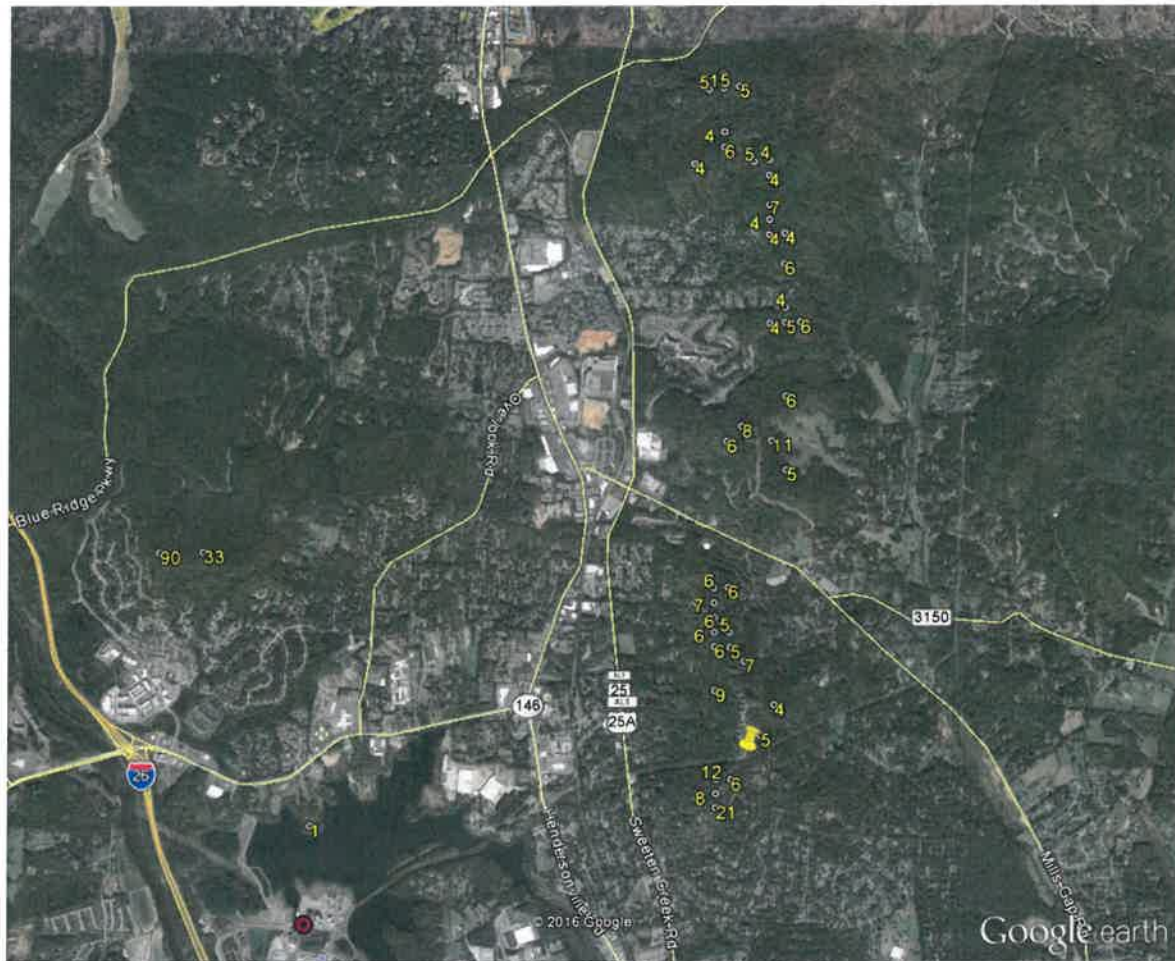


Figure 5. Frequency of Daily Maximum Concentrations for Duke Energy Asheville

Each receptor's frequency value was used with its NDV to create a relative prioritized list of receptor locations. This process is referred to in Appendix A of the Monitoring TAD as a scoring strategy. The list of receptors was developed through the following steps:

1. The NDVs were ranked from highest to lowest. Rank 1 means the highest NDV.
2. The frequencies for the 200 receptors were ranked from the highest to lowest. Rank 1 means the highest number of days having the daily maximum value.
3. The NDV rank and the frequency rank were added together to obtain a score.
4. The scores were ranked from lowest to highest. The receptors with the lowest scores were identified as the most favorable locations for the monitor.

Ranking Results and Discussion of Proposed Monitor Site

Figure 6 shows the receptor locations that ranked in the top 30, note that there were several ties in rankings. North Carolina DAQ staff, in conjunction with Duke Energy staff and a representative from EPA Region 4, conducted an in-situ survey in the vicinity of the Duke Energy Asheville area to select a suitable location for SO₂ monitor placement. The survey focused on the areas to the northeast of the Asheville facility where the higher ranking receptors are located (Figure 6). When selecting adequate locations for the proposed monitor, considerations were made regarding the availability of electrical power, security of the monitor, accessibility, proper instrument exposure, and assurance of long-term use of the site. This last point was especially important, given the tight timelines in the rule. Most of the nearby clear area is privately-owned and there was no guarantee that we could keep the monitor there for at least three years to get a design value.

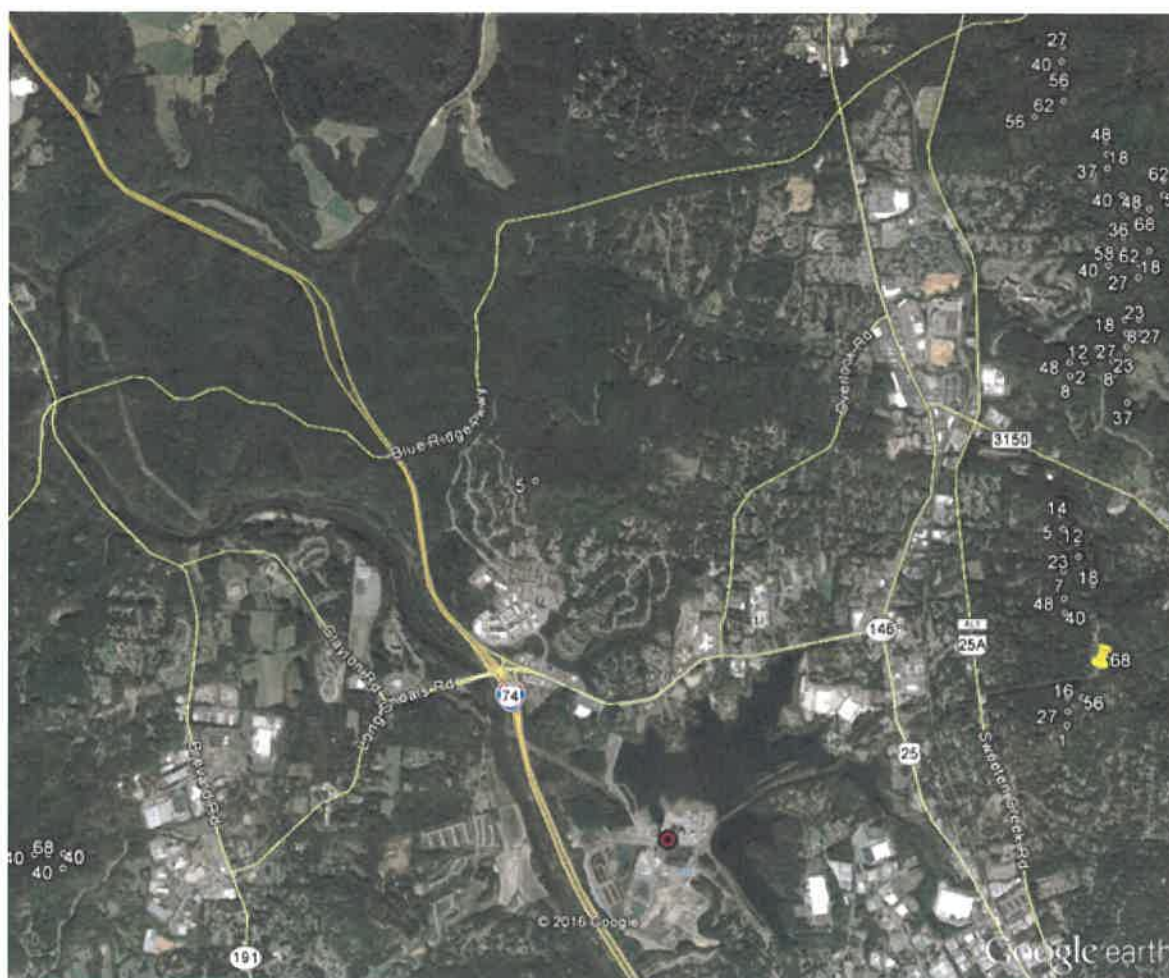


Figure 6. Locations of Top Ranked Receptors for Duke Energy Asheville

Table 2 shows a summary of the ranking results for the top receptors and the proposed monitor location resulting from the site visit conducted using information from the scoring strategy.

Table 2. Selected Ranking Results from the Duke Energy Asheville SO2 Modeling for Monitor Placement

Easting (m)	Northing (m)	Normalized Design Value (NDV)	NDV Ratio	NDV Rank	Freq. Count	Freq. Rank	Score	Score Rank
362,900	3,927,200	0.49	0.78	11	21	3	14	1
362,900	3,928,500	0.63	1.00	1	6	14	15	2
363,100	3,929,800	0.58	0.92	3	8	12	15	2
362,900	3,928,400	0.62	0.98	2	6	14	16	4
359,100	3,929,000	0.44	0.70	16	90	1	17	5
362,900	3,928,600	0.57	0.90	4	7	13	17	5
362,900	3,928,300	0.56	0.89	5	6	14	19	7
363,000	3,929,700	0.54	0.86	6	6	14	20	8
363,300	3,929,700	0.50	0.79	10	11	10	20	8
363,400	3,930,000	0.54	0.86	6	6	14	20	8
363,000	3,932,200	0.47	0.75	13	14	8	21	11
363,000	3,928,500	0.62	0.98	2	0	20	22	12
363,200	3,929,900	0.56	0.89	5	3	17	22	12
362,900	3,928,700	0.51	0.81	9	6	14	23	14
363,400	3,930,500	0.52	0.83	8	5	15	23	14
362,900	3,927,400	0.45	0.71	15	12	9	24	16
363,300	3,929,900	0.57	0.90	4	0	20	24	16
363,100	3,928,200	0.48	0.76	12	7	13	25	18
363,300	3,930,600	0.52	0.83	8	3	17	25	18
363,300	3,931,300	0.48	0.76	12	7	13	25	18
363,400	3,930,100	0.56	0.89	5	0	20	25	18
363,500	3,930,500	0.49	0.78	11	6	14	25	18
363,000	3,928,400	0.49	0.78	11	5	15	26	23
363,300	3,929,800	0.54	0.86	6	0	20	26	23
363,400	3,930,800	0.53	0.84	7	1	19	26	23
363,500	3,930,100	0.54	0.86	6	0	20	26	23
362,900	3,927,300	0.45	0.71	15	8	12	27	27
363,000	3,932,100	0.40	0.63	20	15	7	27	27
363,300	3,930,000	0.53	0.84	7	0	20	27	27
363,300	3,931,100	0.49	0.78	11	4	16	27	27
363,400	3,929,900	0.52	0.83	8	1	19	27	27
363,400	3,930,900	0.47	0.75	13	6	14	27	27
363,500	3,930,000	0.53	0.84	7	0	20	27	27
363,500	3,930,300	0.53	0.84	7	0	20	27	27
363,500	3,930,400	0.51	0.81	9	2	18	27	27

Table 2. Selected Ranking Results from the Duke Energy Asheville SO2 Modeling for Monitor Placement

Easting (m)	Northing (m)	Normalized Design Value (NDV)	NDV Ratio	NDV Rank	Freq. Count	Freq. Rank	Score	Score Rank
363,400	3,930,700	0.52	0.83	8	0	20	28	36
363,100	3,928,300	0.51	0.81	9	0	20	29	37
363,300	3,931,200	0.47	0.75	13	4	16	29	37
363,400	3,929,500	0.46	0.73	14	5	15	29	37
355,500	3,926,400	0.45	0.71	15	5	15	30	40
355,700	3,926,300	0.46	0.73	14	4	16	30	40
355,700	3,926,400	0.44	0.70	16	6	14	30	40
362,900	3,928,000	0.41	0.65	19	9	11	30	40
363,000	3,932,000	0.50	0.79	10	0	20	30	40
363,300	3,930,500	0.46	0.73	14	4	16	30	40
363,300	3,930,700	0.47	0.75	13	3	17	30	40
363,400	3,931,000	0.50	0.79	10	0	20	30	40
362,900	3,928,100	0.47	0.75	13	2	18	31	48
363,000	3,929,800	0.47	0.75	13	2	18	31	48
363,100	3,928,400	0.49	0.78	11	0	20	31	48
363,300	3,931,400	0.47	0.75	13	2	18	31	48
363,300	3,931,500	0.45	0.71	15	4	16	31	48
363,400	3,929,800	0.49	0.78	11	0	20	31	48
363,500	3,930,900	0.49	0.78	11	0	20	31	48
364,900	3,929,900	0.49	0.78	11	0	20	31	48
362,800	3,931,600	0.44	0.70	16	4	16	32	56
363,000	3,927,400	0.42	0.67	18	6	14	32	56
363,000	3,931,800	0.44	0.70	16	4	16	32	56
363,400	3,930,300	0.48	0.76	12	0	20	32	56
363,500	3,930,800	0.48	0.76	12	0	20	32	56
363,700	3,931,000	0.48	0.76	12	0	20	32	56
354,100	3,927,200	0.41	0.65	19	6	14	33	62
363,000	3,931,700	0.41	0.65	19	6	14	33	62
363,600	3,930,600	0.47	0.75	13	0	20	33	62
363,700	3,931,100	0.47	0.75	13	0	20	33	62
364,800	3,929,600	0.47	0.75	13	0	20	33	62
364,800	3,929,800	0.47	0.75	13	0	20	33	62
355,600	3,926,400	0.46	0.73	14	0	20	34	68
Proposed Monitor Location								
362,900	3,931,700	0.46	0.73	14	0	20	34	68

Table 2. Selected Ranking Results from the Duke Energy Asheville SO₂ Modeling for Monitor Placement

Easting (m)	Northing (m)	Normalized Design Value (NDV)	NDV Ratio	NDV Rank	Freq. Count	Freq. Rank	Score	Score Rank
363,000	3,928,600	0.44	0.70	16	2	18	34	68
363,200	3,927,700	0.41	0.65	19	5	15	34	68
363,400	3,930,400	0.44	0.70	16	2	18	34	68
363,400	3,930,600	0.42	0.67	18	4	16	34	58
363,500	3,930,200	0.46	0.73	14	0	20	34	68
363,600	3,930,900	0.46	0.73	14	0	20	34	68
364,800	3,929,700	0.46	0.73	14	0	20	34	68

A proposed location (denoted by the pushpin in Figures 4 through 6) was selected that is approximately 3.4 km northeast of the property line of the Asheville facility. This location is underneath the high tension line tower, in an open location free of trees or other vegetation. The selected location has a score ranking of #68 as indicated in Table 2. The location is the highest of the ranked receptors not located in densely wooded areas. Figure 7 shows the view of the Asheville plant from near the proposed monitor location. Based on this information, DAQ believes that the proposed location is highly suitable for operating an SO₂ monitor.

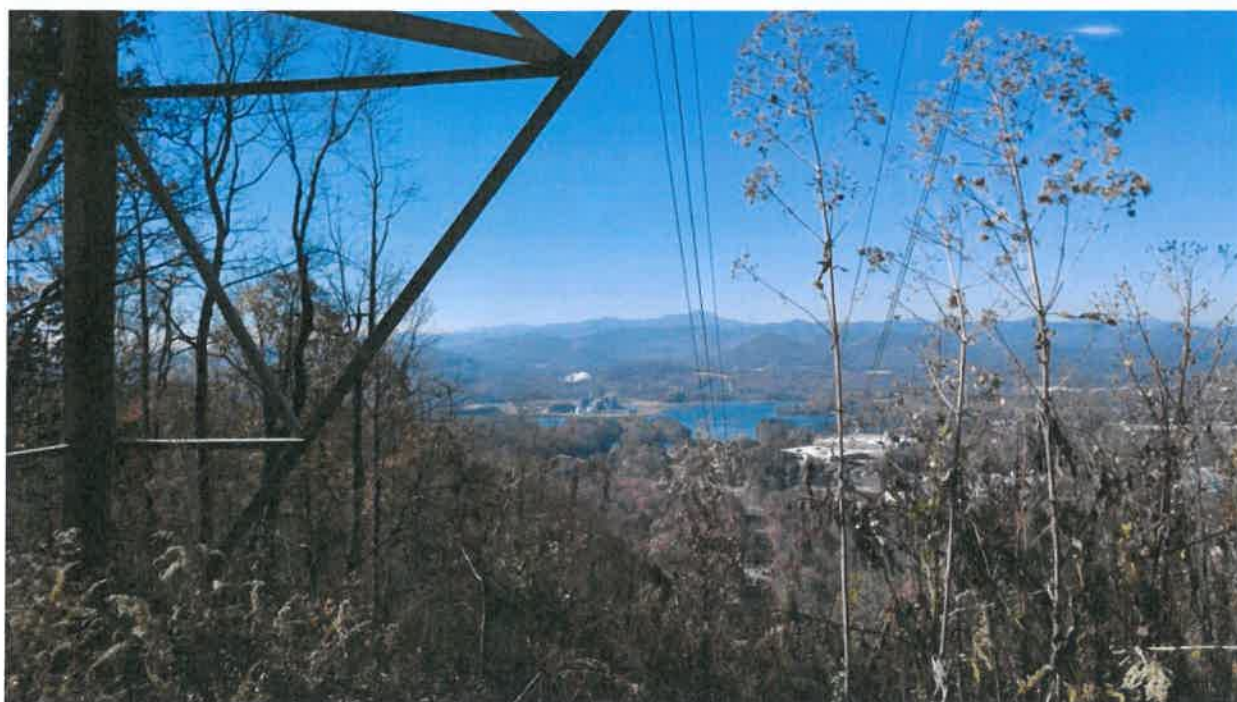


Figure 7. View of Asheville Plant from near the Proposed Monitor Location

Region 4 Requested Information for Proposed Sites

In 2015, the North Carolina Division of Air Quality, DAQ, began working with Duke Energy Progress to establish a sulfur dioxide monitoring station in Skyland, North Carolina, to characterize the ambient sulfur dioxide concentrations near the Asheville steam station. The area chosen for placement of the monitor was selected using the results of modeling done as described in the technical assistance document and reported earlier in this document. An aerial view of the proposed monitoring location identified based on the earlier reported considerations is shown in Figure 8.



Figure 8. Aerial view showing the location of the proposed monitoring station

The Air Quality System identification number for this monitor will be 37-021-0036-42401-1. DAQ will operate this monitor in collaboration with Duke Energy Progress to ensure the air in the Asheville area complies with the national ambient air quality standards for sulfur dioxide. Duke Energy Progress will operate the monitor following the DAQ quality assurance project plan and the monitor will be part of the DAQ primary quality assurance organization. Figure 9 through Figure 16 show views from the proposed site looking north, east, southeast, south, west and northwest.



Figure 9. Looking north from proposed location



Figure 12. Looking northeast from the proposed location

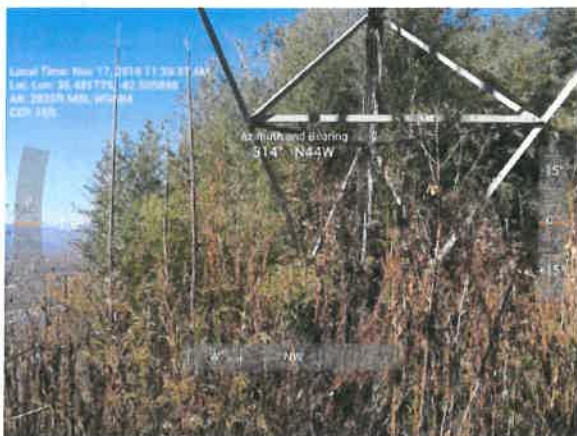


Figure 10. Looking northwest from the proposed location



Figure 13. Looking east from the proposed location

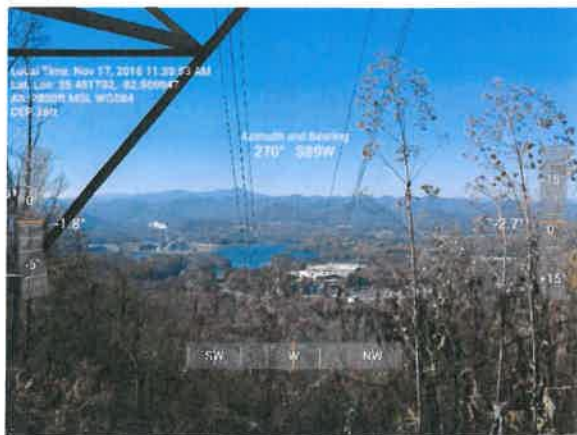


Figure 11. Looking west from the proposed location



Figure 14. Looking southeast from the proposed location



Figure 15. Looking southwest from the proposed location



Figure 16. Looking south from the proposed location

The proposed monitoring site is located at least 10 meters from trees in all directions. The tallest trees are estimated to be 15.2 meters in height. The proposed monitoring site is located approximately 30 meters from the two-story house to the north. The land slopes down to the west and up toward the east. The nearest road is Crestwood Drive located approximately 19 meters to the southeast. This road does not have traffic count data; however, as shown in Figure 17, Royal Pines Road, had an average annual daily traffic count of 1,700 in 2014. The probe height will be approximately 3.6 meters.

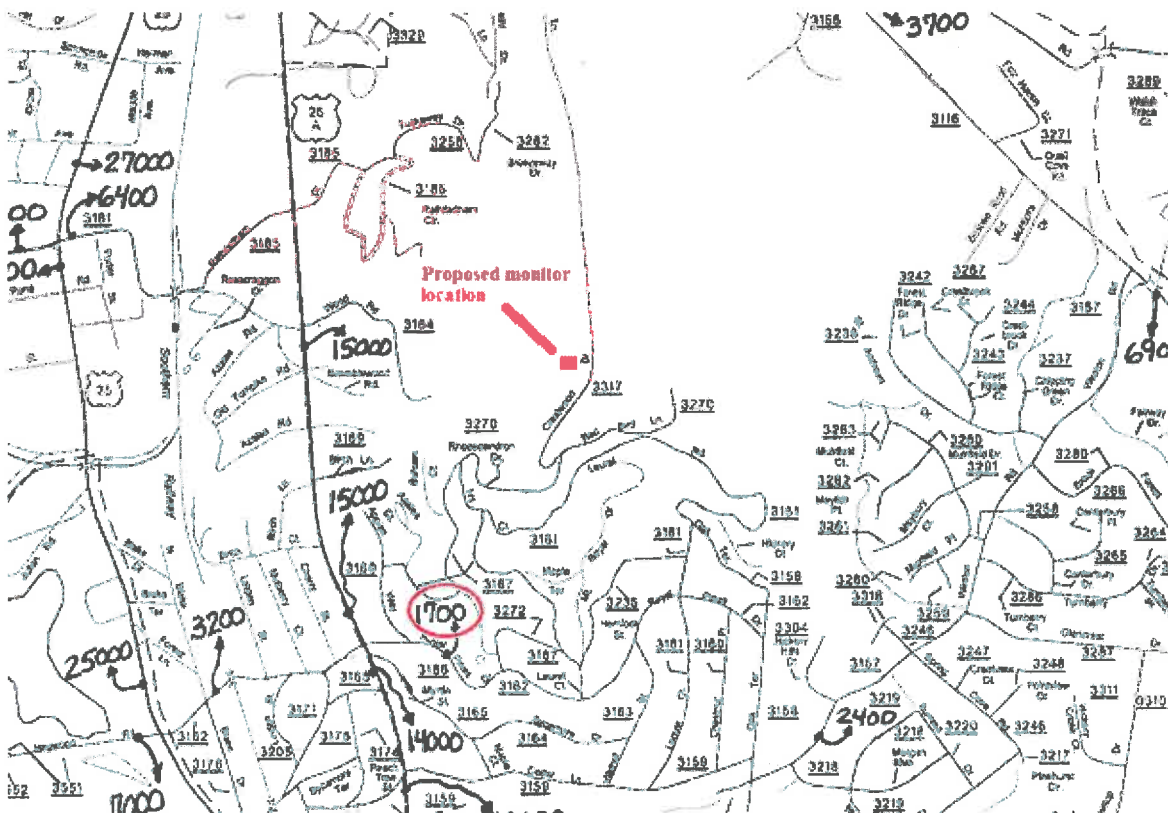


Figure 17. 2014 Traffic count map (from NC DOT)

The Air Quality System, AQS, identification number and street address for the site will be: 37-021-0036 and Crestwood Drive Air Monitor, Asheville Plant, Arden, North Carolina. The latitude and longitude will be 35.481861 and -82.509861. The sampling and analysis method will be AQS code 560, Thermo Electron 43i TLE pulsed fluorescent instrument, EQSA-0486-060, and the operating schedule will be hourly. The monitoring objective will be source oriented. Figure 18 shows the location of the monitoring station relative to the population center of Buncombe County in the Arden area. Based on the wind roses in Figure 19, the proposed monitoring station is not located downwind of the Asheville plant. However, the concentrations are higher at the proposed location than downwind from the plant because the proposed location is at a higher elevation and in the pathway of the plume. The spatial scale of representativeness for the monitor will be neighborhood scale based on the distance of the monitor from the source. The monitor will be located approximately 3.4 kilometers east northeast of the property line for the facility.

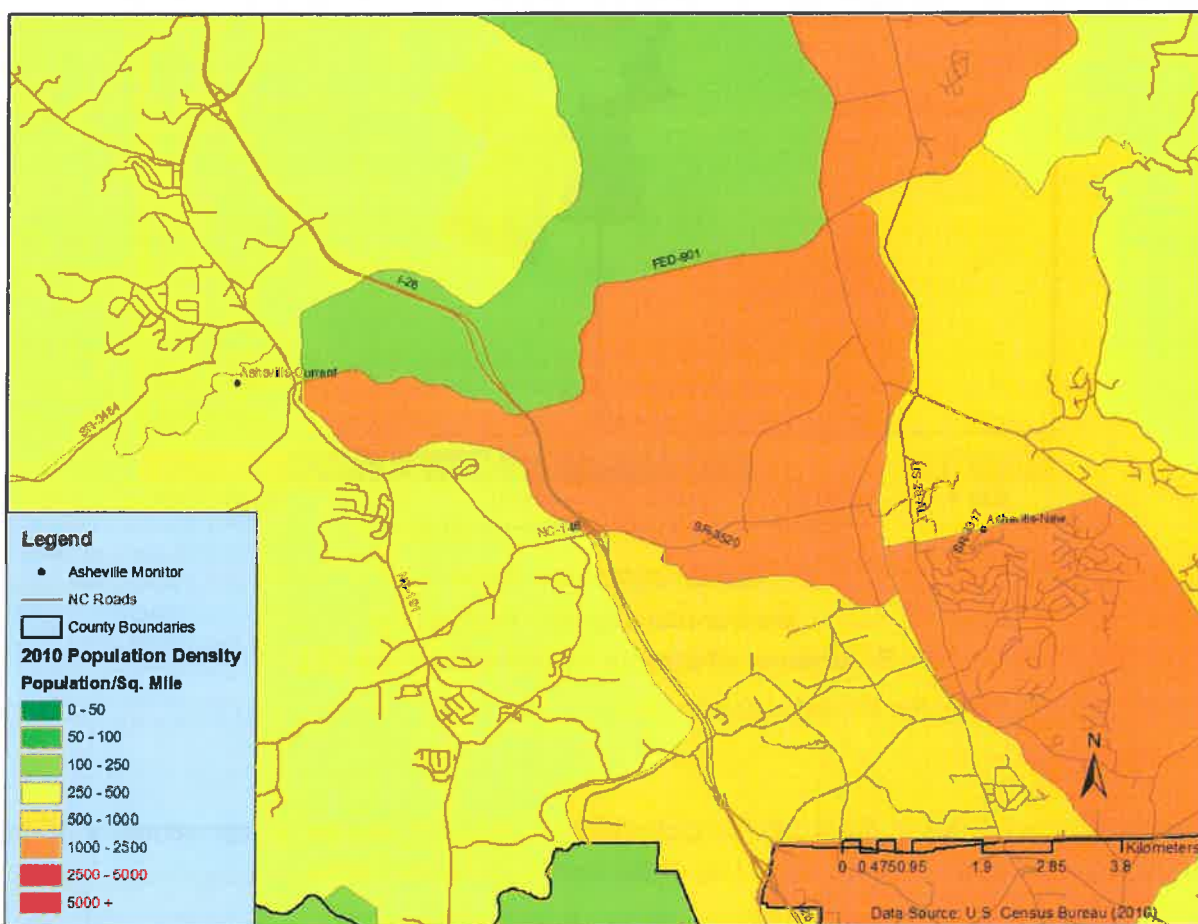
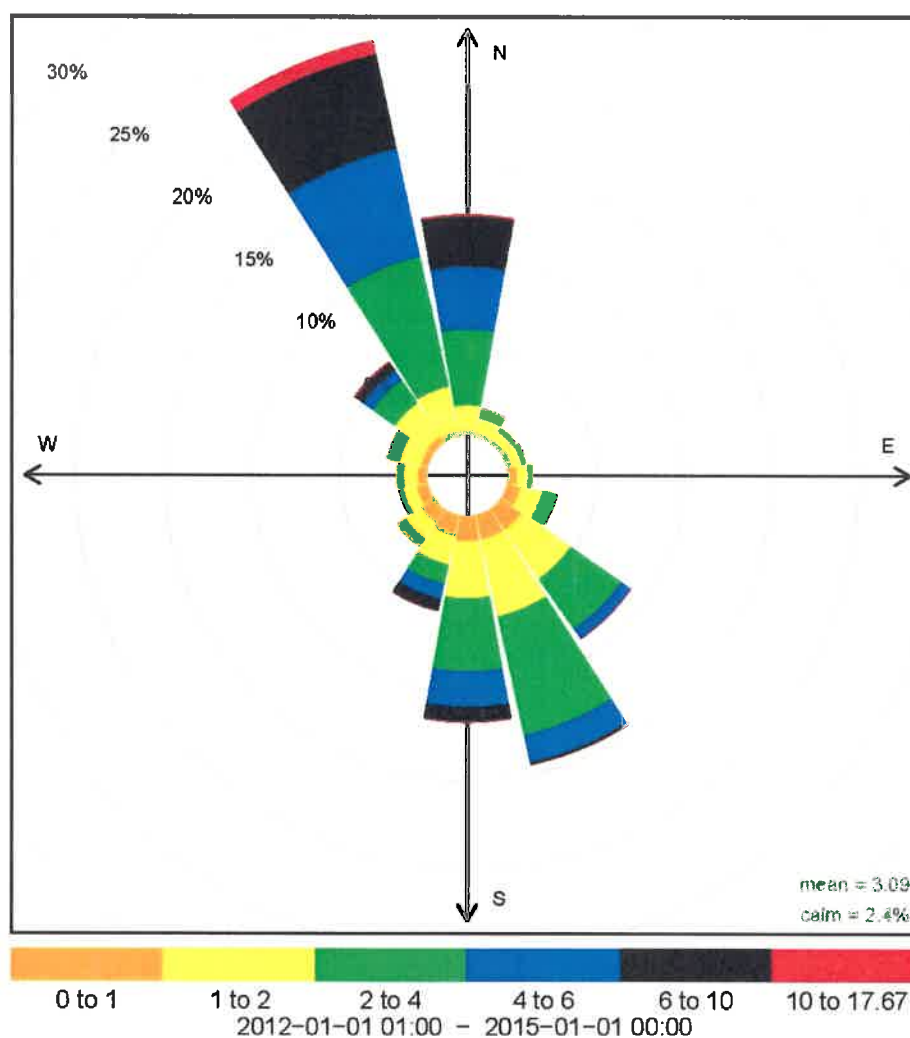


Figure 18. Location of the proposed monitoring station relative to the population of the Arden area in Buncombe County

Asheville Airport Windrose 2012–2014



Number of Records: 26304

Maximum Wind Speed: 17.67 (m / s)

Frequency of counts by wind direction (%)

Figure 19. Wind rose for the Asheville Airport

This monitor is located in the Asheville metropolitan statistical area and is representative of the air quality downwind from the fence line of the Asheville Steam Station.

The proposed monitoring site will be provided to the public for comment during 30 days in December and January as an addendum to the 2016-2017 network monitoring plan.

Table 3 summarizes other factors DAQ evaluated when choosing the proposed location for the monitoring station. Table 4 summarizes the EPA-required information for the proposed special purpose industrial DRR-like Skyland site.

Table 3. Other considerations in site selection

Factor	Evaluation
Long-term Site Commitment	The proposed location is on land to which Duke has obtained a lease and also already has access for maintenance of power transmission lines. Because the area is needed for the power transmission lines it will not be developed any time in the next three years
Sufficient Operating Space	20-meter by 35-meter open area free of trees and buildings.
Access and Security	The building will be on the right of way for the power transmission lines and underneath the tower.
Safety	Appropriate electrical permits will be obtained.
Power	Location is approximately 15 meters from transformer.
Environmental Control	The monitoring shelter will be a 6 foot by foot trailer with the tongue of the trailer facing south.
Exposure	The monitoring station will be at least 10 meters from the driplines of trees and there will not be any trees or buildings between the monitor and the source.
Distance from Nearby Emitters	There are no other permitted facilities within 0.5 miles of the proposed location.
Proximity to Other Measurements	The proposed monitoring station is located about 7 kilometers northeast of the Asheville Regional Airport and 11 kilometers east southeast of the Bent Creek ozone monitoring station.

Table 4. The 2016-2017 Sulfur Dioxide Monitoring Network for the Asheville MSA ^a

AQS Site Id Number:	37-021-0036
Site Name:	Skyland
Street Address:	Crestwood Drive Air Monitor, Asheville Plant
City:	Arden
Latitude:	35.481861
Longitude:	-82.509861
MSA, CSA or CBSA represented:	Asheville
Monitor Type:	Industrial special purpose
Operating Schedule:	Hourly – every year
Statement of Purpose:	Maximum concentration site in the vicinity of the Duke Progress Energy Asheville Plant. Compliance w/NAAQS.
Monitoring Objective:	Source-oriented
Scale:	Neighborhood
Suitable for Comparison to NAAQS:	Yes
Meets Requirements of Part 58 Appendix A:	Yes
Meets Requirements of Part 58 Appendix C:	Yes: EQSA-0486-060
Meets Requirements of Part 58 Appendix D:	No
Meets Requirements of Part 58 Appendix E:	Yes
Proposal to Move or Change:	Monitoring will begin by Jan. 1, 2017

^a The monitor uses an instrumental pulsed fluorescence method using a Thermo Electron 43i-TLE, Air Quality System, AQS, method code 560.